

Application Serial No: 10/754,403
Responsive to the Office Action mailed on: April 5, 2007

REMARKS

This Amendment is in response to the Office Action mailed on April 5, 2007. No new matter is added. Claims 1 and 2 are amended editorially and are supported, for example, in the specification on page 6, lines 3-16. Claims 19 and 20 are new and are supported, for example, in the specification on page 7, line 34-page 8, line 10. Claims 1-20 are pending.

103(a) Rejections:

Claims 1-4, 9-13 and 16-18 are rejected as being unpatentable Shibazaki (US Patent No. 6,999,119) in view of Kijima (US Patent 6,882,366). This rejection is traversed.

Claim 1 is directed to a solid-state imaging device that requires, among other features, an imaging region in which a plurality of pixels are arranged and a signal line. The adding circuit of claim 1 comprises an adding portion, a gain control portion and a storage portion, so that an output of the adding circuit is subjected to a gain control by the gain control portion and then stored in the storage portion. Claim 1 also requires that on the basis of a predetermined reference quantity of light incident onto the imaging region, a gain of the adding circuit in a condition in which a quantity of the incident light is above the reference quantity is controlled to be smaller than a gain of the adding circuit in a condition in which a quantity of the incident light is below the reference quantity. An advantage of these features is a solid-state imaging device with an adding circuit with a wide dynamic range that obtains high-sensitivity and is capable of adding signals from a large quantity of incident light.

The combination of Shibazaki and Kijima does not teach or suggest these features. The rejection relies on Kijima for teaching that on the basis of a predetermined reference quantity of light incident onto the imaging region, a gain of the adding circuit in a condition in which a quantity of the incident light is above the reference quantity is controlled to be smaller than a gain of the adding circuit in a condition in which a quantity of the incident light is below the reference quantity. Kijima is directed to an electronic imaging system that teaches a CCD (1), a CDS circuit (2) for removing a noise from the output of the CCD, a gain control amplifier (3) for controlling the gain of

Application Serial No: 10/754,403
Responsive to the Office Action mailed on: April 5, 2007

an output of the CDS, and an A/D converter (4). The gain control amplifier (3) is provided separately from the CCD 1 and amplifies electric signals outputted from all of the pixels with a uniform gain in accordance with an input range of the A/D converter (4). The rejection interprets the CCD (1) as the adding circuit of claim 1. However, the gain control amplifier (3) is separate from the CCD (1) and not comprised within CCD (1) as required of the gain control portion of claim 1. Thus, Kijima does not teach or suggest an adding circuit that has an adding portion, a gain control portion and a storage portion, so that an output of the adding circuit is stored in the storage portion after gain controlling.

Moreover, the gain control amplifier (3) of Kijima amplifies electric signals outputted from all of the pixels with a uniform gain in accordance with an input range of the A/D converter (4). Thus, the gain is constant with respect to all pixels. Also, the gain control amplifier (3) is controlled based on an output of an auto exposure control circuit (11). Nowhere does Kijima teach or suggest that on the basis of a predetermined reference quantity of light incident onto the imaging region, a gain of the CCD (1) in a condition in which a quantity of the incident light is above the reference quantity is controlled to be smaller than a gain of the CCD (1) in a condition in which a quantity of the incident light is below the reference quantity as required by the adding circuit of claim 1.

Shibazaki does not overcome the deficiencies of Kijima. Shibazaki is directed to an image capturing element (1) with a vertical transfer circuit (2). The rejection interprets the vertical transfer circuit (2) as the adding circuit of claim 1. However, nowhere does Shibazaki teach or suggest that the vertical transfer circuit (2) comprises a gain control portion and that on the basis of a predetermined reference quantity of light incident onto the imaging region, a gain of the vertical transfer circuit (2) in a condition in which a quantity of the incident light is above the reference quantity is controlled to be smaller than a gain of the vertical transfer circuit (2) in a condition in which a quantity of the incident light is below the reference quantity. For at least these reasons claim 1 is not suggested by the combination of Shibazaki and Kijima and should be allowed. Claims 3, 4 and 9-11 depend from claim 1 and should be allowed for at least the same reasons.

Application Serial No: 10/754,403
Responsive to the Office Action mailed on: April 5, 2007

Claim 2 is directed to a solid-state imaging device that requires, among other features, an imaging region in which a plurality of pixels are arranged and a signal line. The adding circuit of claim 2 comprises an adding portion, a gain control portion and a storage portion, so that an output of the adding circuit is subjected to a gain control by the gain control portion and then stored in the storage portion. Claim 2 also requires that within at least a partial range of a quantity of incident light onto the imaging region, a gain of the adding circuit is controlled to decrease with an increase of the quantity of the incident light. An advantage of these features is a solid-state imaging device with an adding circuit with a wide dynamic range that obtains high-sensitivity and is capable of adding signals from a large quantity of incident light.

The combination of Shibazaki and Kijima does not teach or suggest these features. The rejection relies on Kijima for teaching that within at least a partial range of a quantity of incident light onto the imaging region, a gain of the adding circuit is controlled to decrease with an increase of the quantity of the incident light. Kijima is directed to an electronic imaging system that teaches a CCD (1), a CDS circuit (2) for removing a noise from the output of the CCD, a gain control amplifier (3) for controlling the gain of an output of the CDS, and an A/D converter (4). The gain control amplifier (3) is provided separately from the CCD 1 and amplifies electric signals outputted from all of the pixels with a uniform gain in accordance with an input range of the A/D converter (4). The rejection interprets the CCD (1) as the adding circuit of claim 2. However, the gain control amplifier (3) is separate from the CCD (1) and not comprised within CCD (1) as required of the gain control portion of claim 2. Thus, Kijima does not teach or suggest an adding circuit that has an adding portion, a gain control portion and a storage portion, so that an output of the adding circuit is stored in the storage portion after gain controlling.

Moreover, the gain control amplifier (3) of Kijima amplifies electric signals outputted from all of the pixels with a uniform gain in accordance with an input range of the A/D converter (4). Thus, the gain is constant with respect to all pixels. Also, the gain control amplifier (3) is controlled based on an output of an auto exposure control circuit (11). Nowhere does Kijima teach or suggest that within at least a partial range of a quantity of incident light onto the imaging region, a gain of the CCD (1) is controlled to

Application Serial No: 10/754,403
Responsive to the Office Action mailed on: April 5, 2007

decrease with an increase of the quantity of the incident light as required by the adding circuit of claim 2.

Shibazaki does not overcome the deficiencies of Kijima. Shibazaki is directed to a image capturing element (1) with a vertical transfer circuit (2). The rejection interprets the vertical transfer circuit (2) as the adding circuit of claim 2. However, nowhere does Shibazaki teach or suggest that the vertical transfer circuit (2) comprises a gain control portion and that within at least a partial range of a quantity of incident light onto the imaging region, a gain of the vertical transfer circuit (2) is controlled to decrease with an increase of the quantity of the incident light. For at least these reasons claim 2 is not suggested by the combination of Shibazaki and Kijima and should be allowed. Claims 12, 13 and 16-18 depend from claim 2 and should be allowed for at least the same reasons.

Claims 5, 8, 14 and 15 are rejected as being unpatentable Shibazaki in view of Kijima and further in view of Trevino (US Patent Publication No. 2002/0012056). This rejection is traversed. Claims 5 and 8 depend from claim 1 and should be allowed for at least the same reasons discussed above. Similarly, claims 14 and 15 depend from claim 2 and should be allowed for at least the same reasons discussed above. Applicants do not concede the correctness of this rejection.

Claims 6 and 7 are rejected as being unpatentable Shibazaki in view of Kijima and further in view of Takayama (US Patent No. 7,088,395). This rejection is traversed. Claims 6 and 7 depend from claim 1 and should be allowed for at least the same reasons discussed above. Applicants do not concede the correctness of this rejection.

New Claims 19 and 20:

New claims 19 and 20 depend from claims 1 and 2, respectively, and should be allowed for at least the same reasons discussed above.

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Application Serial No: 10/754,403
Responsive to the Office Action mailed on: April 5, 2007

Conclusion:

Applicants respectfully assert claims 1-20 are in condition for allowance. If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicants' primary attorney-of record, Douglas P. Mueller (Reg. No. 30,300), at (612) 455-3804.



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Respectfully submitted,

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